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The Vital Constituent

Man's life depends on other life, that which teems within the soil underfoot. For a true soil requires the presence and decay of some organic matter along with the activity of its inseparable microorganisms—otherwise it would merely be an aggregation of mineral and rock fragments. The soil draws its vitality from nature's all-embracing cycle wherein plants and animals live, die, and return to the land so that new life springs eternally from old. From ancient times farmers have exploited this cycle by returning manure and crop residues to the land. The Greek historian Xenophon, for example, observed that for maintaining soil fertility "there is nothing quite so good as manure."

Today's farmers know that organic matter exerts many physical, chemical, and biochemical influences upon soil, although not all of them are fully understood. Enthusiastic gardeners often ascribe mystical and magical properties to organic matter, but the proven benefits of this vital constituent of soils—typically 1 to 3 percent—are sufficiently awesome. Organic matter imparts dark color, favors granulation, enhances root development, retards erosion, increases water-holding power and exchange capacity, renders such nutrients as phosphorus and iron more available, provides stores of nitrogen and sulfur, and feeds microbial life so that through complex biological processes it can mobilize and release a steady stream of nutrients for plant growth.

Until about 1940 it was widely held that good crops required manure. Research since has shown that with many soils and cropping systems the use of inorganic fertilizers alone will not only maintain soil organic matter levels, but will increase them through the greater production of crop residues, especially those from roots. Put another way, inorganic fertilizers plus microorganisms can produce larger and more nutritious crops than can microorganisms alone. It should also be noted that organic matter oxidizes rapidly in humid regions, limiting its buildup in the soil.

Manure, presently considered too costly to handle, will loom in importance as the energy crisis deepens. Prodigious amounts of energy are required to make and distribute inorganic fertilizers. Applied on the farm, manure can cut transportation costs and substitute for part of the nitrogen obtained from commercial fertilizer. Agricultural science will steadily devise better soil management systems, including the role of organic matter, and, in Nathaniel Shaler's memorable phrase, "keep the earth fit to bear the life to come."

Editor: *R. P. Kaniuka*

Contributors to this issue:
R. C. Bjork, V. R. Bourdette, P. L. Goodin, M. C. Guilford, G. B. Hardin, W. W. Martin, D. H. Mayberry, D. H. Senft, E. L. Razinsky, N. E. Roberts, L. C. Yarris

COVER: Male-sterile soybeans mark a significant research advance toward higher yielding varieties. The pod depicted in this high-contrast photo contains a single seed, a typical trait of male-sterile soybean plants (1073X1628–16). Article begins on page 8.

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Earl L. Butz, Secretary
U.S. Department of Agriculture

Talcott W. Edminster, Administrator
Agricultural Research Service

Complementary pastures for more beef

SOUTHERN GREAT PLAINS ranchers whose herds are now grazing only native range may be able to increase yearly per acre beef production from about 44 to as much as 185 pounds.

How? Complementary pastures.

ARS studies show that three combinations of complementary pastures, depending only on natural precipitation for plant moisture, can improve the acres-per-head ratio from 8.8 to 1 for native rangeland to as little as 2 to 1 for the most intensely farmed system.

The studies were conducted at the ARS Southern Great Plains Field Station, Woodward, Okla., by agronomist Ernest H. McIlvain and range scientist Marvin C. Shoop over a 6-year period.

Agronomist Ernest H. McIlvain inspects mid-November growth of lovegrass. This pasture had been grazed until September and is being allowed to reestablish growth through November. The cattle in background, presently on native range, will return to lovegrass forage near the 1st of December (1173W1686–26).

The three complementary systems were (1) native range plus weeping lovegrass, (2) native range plus wheat-sudan, and (3) weeping lovegrass plus wheat-sudan.

Each system was complete within itself and maintained stocker steers—all high-grade Herefords—from the time they were weaned in late October to the time they were sold as feeder steers 1 year later. The systems were compared with year-long grazing of native range and were started in 1966.

The native range-plus-lovegrass system was based on using 90 percent of the total land in the system as native range and only 10 percent as intensely managed, cross-fenced lovegrass. Each steer had rotational use of 4.5 acres of native range plus 0.5 acre of lovegrass. The steers gained an average 360 pounds per head and 72 pounds per acre for a net return of $6.40 per acre, based on 1971–72 prices.

The native range-plus-wheat-sudan system was based on using 75 percent of the land as native range and 25 percent as farmland double cropped to graze-out wheat each October and to graze-out hybrid sudan each June. Each steer had rotational use of 3 acres of native range plus 1 acre of wheat-sudan. Gains averaged 420 pounds per head and 93 pounds per acre for a net return of $10 per acre.

The lovegrass plus wheat-sudan system split the land in two, one half for lovegrass and the other half for double-cropped wheat-sudan. Each steer had 1 acre of lovegrass and 1 acre of wheat-

Above: *Cattle driven by an ARS cowboy come off native range onto complementary pasture seeded to winter wheat (1173W1685–1).* ***Below:*** *An annual rainfall of 20–25 inches allows researchers at Woodward to double-crop stand of wheat-sudan by grazing out each crop before replanting. Here, research aide Richard Hurst inspects quality of wheat pasture in early September. Wheat will be grazed through the winter until mid-May when the soil will be lightly tilled, then replanted with sudan (1173W1685–11).*

sudan. In this system weight gains averaged 370 pounds per steer and 185 pounds per acre for a net return of $13.50 for each acre in the system. This was 350 percent of the returns made by steers on year-round native range.

During all the tests steers on dry winter range were supplemented with 5 pounds of 41 percent protein cottonseed pellets fed twice each week, with salt freely available. They were never fed hay.

Steers on wheat in winter had free access to sorghum hay, which they consumed at a rate of about 1 pound daily, and to a commercial mineral supplement. The only supplement fed in summer was salt.

The scientists point out that the major value of tame pasture such as weeping lovegrass is quantity, while that of farmed forage such as wheat and sudan is quality. Native range is considered to provide stability and flexibility.

A dividend of any practice that doubles the number of cattle on a range also cuts in half the cost per animal of other improvement practices such as brush control, insect control, mowing, fencing, and fertilization. In fact, a range improvement practice that may not be economically sound in an all native range grazing program could become highly profitable in a complementary pasture system. □

Chips with a golden ring

THE TRADITION of divesting potato chips of the "spud's" peel is under question.

ARS and Minnesota Agricultural Experiment Station scientists have learned that chips from peeled and unpeeled potatoes rate similar in flavor, appearance, and shelf life. Their studies, originating at the Red River Valley Potato Research Center, East Grand Forks, Minn., also indicated a greater yield from unpeeled potatoes and less processing waste.

Would consumers accept the novel chips? Two six-member panels at the University of Minnesota evaluated flavor and appearance of unsalted chips made from peeled and unpeeled potatoes. They expressed no clear preferences. The potato chips had been stored at room temperature for 1, 3, 6, and 9 weeks.

One panel was intentionally biased. Its members were told in advance that some of the potatoes had not been peeled, leaving a "golden ring" on the potatoes, an approach that would supply three benefits. First, one processing step was eliminated, thus lowering cost to the consumer. Second, not peeling the potatoes alleviated a waste disposal problem—a real contribution toward solving an environmental problem. And third, potato chips with the golden ring were probably more nutritious because many of the nutrients in potatoes are found close to the peel.

Biased and unbiased panels did not give significantly different responses. The acceptability of both unpeeled and peeled chips declined, as expected, with longer storage time.

Results of the evaluations were supported at the ARS Northern Regional Research Laboratory, Peoria, Ill., by still another panel. This panel evaluated the flavor stability of chips stored at 140° F. for periods of 1 and 2 weeks.

Chemists at the Peoria laboratory determined that oil in the chips of peeled and unpeeled potatoes deteriorated similarly with aging, but oil content was greater by 2.76 percent in unpeeled chips. Differences in oil content proved of minor consequence in sensory evaluations, however. The chips were fried in a commercial blend of cottonseed-corn oil.

Greater oil content partially accounted for an increased yield obtained by not peeling potatoes, but there was also an increase in potato solids. The total increase in yield of chips was about 4½ pounds for each 100 pounds of potatoes.

The idea of not peeling potatoes before chipping was triggered when scientists observed the reactions of visitors, including operators of potato chip plants, touring the Red River Valley laboratory. Visitors rarely noticed that potato chip samples run through a simple chip test were not peeled. If the presence of the peel elicited so little reaction, scientists reasoned, why should peeling be done at all?

Further research will be needed, to help determine the levels or fate of agricultural chemicals that may be present in the peel of the potatoes. □

Plant geneticist Donald K. Barnes parts rows of alfalfa plants, revealing vigorous growth of Agate variety in comparison to susceptible variety on left. Diminished foliage reflects the amount of fungus infection. The alfalfa was grown in an irrigated nursery with the moisture precisely controlled (1073X1536–24).

Dry feet for a Queen

SCIENTISTS have gone Sir Walter Raleigh one better by more than merely cloaking the problem of "wet feet" for alfalfa, the Queen of Forages.

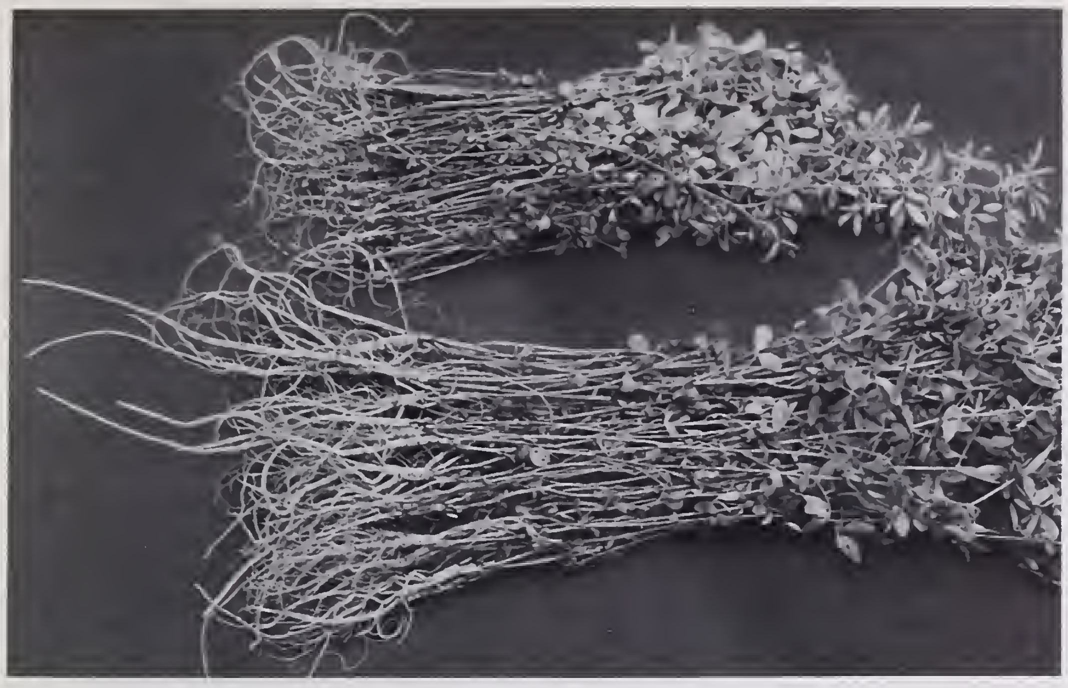
Geneticist Donald K. Barnes and pathologist Fred I. Frosheiser, both of ARS and based at the University of Minnesota, Minneapolis, have developed a new alfalfa variety and two new breeding lines especially adapted to wet soils.

"It was long assumed," Dr. Frosheiser said, "that alfalfa could not tolerate wet feet. We now know that it usually is not water itself that causes stand losses." It is a fungus that cannot infect without free water, he added. "*Phytophthora megasperma* is a water mold. Its spores swim about and infect alfalfa roots causing them to rot. The disease will develop in almost any soil that remains excessively wet 10 days or longer." The rot progresses while the soil remains wet. Many plants that appear to recover when the soil dries will end up with shallow root systems, lacking the long tap roots necessary for high forage yields during dry weather.

Root rot can be severe enough to discourage many farmers with wet soils from planting alfalfa, especially in the Midwest from Kansas to Ohio, and in the Southwest. They substitute some other legume or a grass. The disease is not limited to chronically wet soils; it can cause problems on better drained soils in unusually wet weather. It has even been observed in sandy soils.

To remedy these problems, the ARS scientists developed Agate, the first winter hardy variety resistant to *Phytophthora* root rot. Certified seed will be available in the spring of 1974. Agate will grow on heavy or poorly drained soils not suitable for other varieties, and sustains reduced root rot losses caused by excessive rain on new stands.

Agate also resists common leaf spot



Comparison of root systems of mold resistant and susceptible alfalfa plants clearly show superiority of Agate, a newly developed variety. Grown under Phytopthora *conditions, Agate developed long, well formed roots and lush foliage; the susceptible variety sustained shallow root development with resultant stand loss (1073X1537–5).*

and bacterial wilt. It is adapted to most areas in the upper Midwest. It outyields other varieties under root rot conditions and yields as well as Vernal, the most widely used variety in the Midwest, where root rot is not limiting.

The ARS-developed breeding lines—MnP–B1 and MnP–D1—have root rot resistance equal to that of the variety Agate. Released to breeders in 1972, these lines offer *Phytophthora*-resistant germplasm adapted to most of North America. Their broad ancestry insures that root rot-resistant varieties developed in the future will not stem from one genetic background.

MnP–B1 ancestry traces back to resistant plants selected from 29 winter hardy or moderately hardy varieties. The MnP–D1 line began with resistant plants selected from 14 varieties adapted to the Southwest. Agate, by comparison, has a narrower genetic base. It was developed from root rot-resistant plants, selected from a new long-lived variety, Ramsey, and several Vernal-type varieties.

The development of Agate and the two *Phytophthora*-resistant breeding lines was made possible by field and greenhouse procedures that Dr. Frosheiser and Dr. Barnes devised to screen alfalfa plants for root rot resistance.

Critical steps in the field procedure include inoculating the soil with *Phytophthora,* completely leveling the seedbed to provide uniform distribution of water, and seeding and keeping the soil wet for 2 to 3 weeks by daily irrigation. In the greenhouse, seedlings are tested in inoculated sand in tanks where water levels are maintained by subsurface irrigation. In both procedures, plants are examined visually and scored from 1 through 5 with increasing root damage. Dead plants are scored 6.

Either procedure can be used to screen and evaluate *Phytophthora*-resistant plants. The scientists believe the field procedure to be superior in a breeding program. Field procedures permit a breeder to select plants for yield and resistance to pests as well as to *Phytophthora.* The greenhouse procedure, however, permits breeders to conduct two cycles of selection each year, instead of one in the field.

By employing a combination of field and greenhouse procedures, Dr. Frosheiser and Dr. Barnes have increased the proportion of rot-resistant plants in several alfalfa populations from less than 10 to about 50 percent the first year. The widespread application of these procedures will facilitate the breeding of other resistant alfalfas for the future. □

Scientists screen and evaluate alfalfa varieties for Phytopthora resistance in both greenhouse and field. Here, Dr. Frosheiser (left) and Dr. Barnes compare root systems of susceptible and resistant plants (1073X1535–8).

The Goal: Hybrid S

FOR YEARS plant breeders have pressed toward an elusive goal: a hybrid soybean that would overcome current yield and production barriers. A recent discovery by a plant breeder brings the goal a step nearer.

ARS plant breeder Charles A. Brim and colleagues at the North Carolina Agricultural Experiment Station. Raleigh, have demonstrated the inheritance of male sterility in soybeans, and have developed a soybean line possessing the male-sterile character. Although it is not the soybean needed to vitalize economic commercial production, it does have the male-sterile character needed for developing new plant material. Dr. Brim stresses that male sterility should not be confused with cytoplasmic sterility, the breeding tool used in developing hybrid corn.

Here's how plant breeders exploit the male-sterile character. Normally, soybeans are self-pollinating: that is, each flower has a fertile male and female organ. The pollen is shed and fertilization occurs before the flower opens. In order to generate the variability needed for selection that is not generated with self-pollination, flowers must be hand-pollinated. This requires removal of pollen that may be on the flower and introducing pollen from another source. Pollination by hand is, of course, expensive and time consuming.

In a male-sterile plant the pollen is inviable but the female part of the plant is fertile, so these plants can serve as the female parents in a cross. They cannot pollinate themselves, but can be planted close to male-fertile plants and natural crossing will occur.

A plant breeder can therefore avoid hand pollination merely by interplanting the intended male-fertile and male-sterile parents and relying on insects to

Dr. Brim inspects the foliage of experimental soybean lines for insect damage. Success of this research hinges on pollination by insects, precluding the use of pesticides (1073X1628–24).

Dr. Brim inspects mature male-sterile soybean plants in a test "block" where natural crossing occurs. Here, both male-sterile and male-fertile plants were mixed at random at time of planting. The male-sterile plants stay green and retain their foliage long after maturing, requiring researchers to force defoliation in order to harvest (1073X1629–4).

oybeans

transfer fertile pollen to the female parent plants.

"With this technique," explains Dr. Brim, "a plant breeder can make more crosses in a year than he could have gotten in a lifetime before." Hand pollination usually produces one to two seeds per cross, but with the male-sterile system, literally hundreds of cross seeds can be obtained at much lower cost to the breeder. This technique, then, can hasten the development of soybean lines with the economically important characteristics that farmers want.

Potential benefits from easier hybridization of soybeans include resistance to disease, shattering, and lodging, as well as increased yields—benefits which bolster bank accounts for farmers, and provide a better final product for consumers.

Dr. Brim points out that already there are lines of soybeans with the kind of

yield potential needed to substantially raise the U.S. average yield of about 28 bushels per acre, with top producers averaging over 40 bushels with available varieties.

Cross breeding can make it possible to improve on the 40 bushel yield, but even if this yield is just maintained, raising the U.S. yield average to 40 bushels would bring growers an extra $70 an acre, or over $3 billion at current soybean prices. The big challenge is to develop varieties with even higher yield potentials.

A major question remains: Is there a hybrid soybean? "No," says Dr. Brim, "this is a first, fumbling step, and we have a long way to go." The fact remains, however, that this ARS research advance may make it possible to break down old barriers to improved soybean yields. □

Fertile lines of experimental soybeans are harvested with a specially designed plot harvester. These soybeans are the progeny of male-sterile and male-fertile crosses that were harvested the year before (1073X1627–11).

Each test plot is harvested separately, then the seeds are bagged, weighed, and catalogued in the field—thus assuring purity of line. Later, scientists take samples from each bag to analyze them for oil and protein content. Seeds from plots with the highest yields are chosen as the parents for the next cycle of intermating with male-sterile lines (1073X1627–17).

Nemotode parasitizes boll weevil

IF IT CAN be mass produced, an elongated roundworm may someday turn into a million dollar baby for the U.S. cotton economy.

A new genus of a nematode that parasitizes the boll weevil has been found for the first time in North America. A natural enemy of the boll weevil, it is a wormlike parasite which penetrates the body cavity of the insect and kills it. The nematode causes the weevil to emerge from hibernation abnormally early. Especially hungry because the parasites have depleted their stored fat, the weevils invade the cotton fields in late March, 4 to 6 weeks before the cotton is planted. Finding no cotton, they die, meanwhile releasing the female nematodes in the soil to infest later generations of weevils.

Cotton producers across the nation lose up to $200 million annually because of the boll weevil, and suppression costs an additional $75 million. Nearly one-third of all insecticides applied to crops are used to fight the weevil, found nearly 80 years ago in South Texas. Control has depended on insecticides, release of sexually sterile male boll weevils, and preventive cultural practices. More recently, traps have been set in cotton fields to lure boll weevils by means of chemical sex attractants called pheromones.

Study of the parasite began in 1960 when ARS entomologist Tomie C. Cleveland found the nematode in weevils collected from ground trash in Madison Parish, Louisiana. Because the specimen was immature, the species was undetermined but thought to be in the genus *Hexamermis.*

Further research was conducted in 1971 at the former USDA laboratory in Tallulah, Louisiana. Mr. Cleveland made ground trash collections in northeast Louisiana and set weevil traps in Madison and Tensas Parishes. Boll weevils from trash collections were then placed in large screen cages adjacent to hibernation sites.

In 4 months 110 weevils were removed and recaged in a 3-gallon bucket of soil topped by 2½ inches of woods trash. Holes were drilled in the bottom of the bucket and it was set in a tray of water to keep the soil moist.

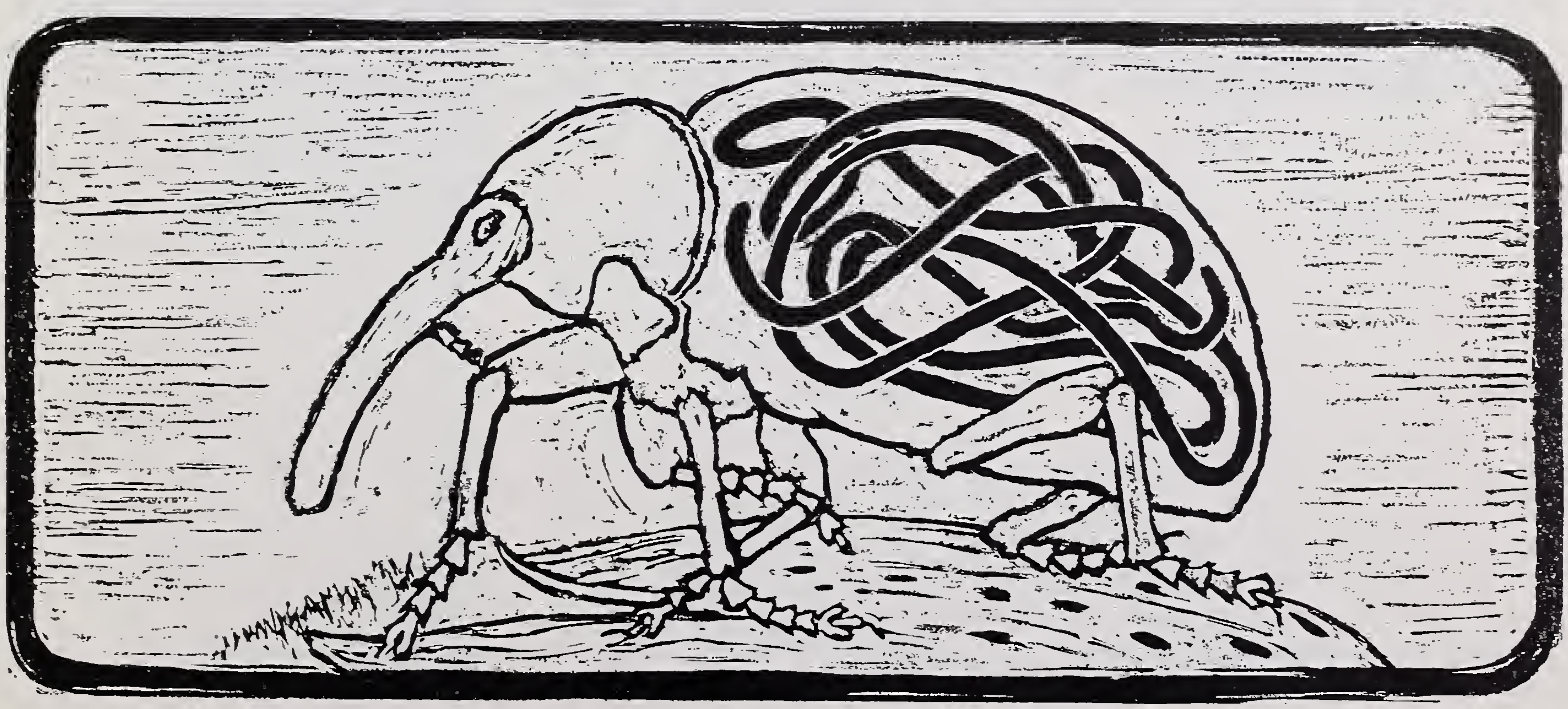
In approximately 12 weeks, small quantities of soil were removed and washed through a fine wire screen for microscopic examination. Seven adult nematodes were recovered, then sent to nemotologist William R. Nickle, Beltsville, Md., who on examination found them to be a new genus of *Mermithidae.*

Immature nematodes were found in weevils captured in weevil traps in Louisiana from 1970 through June 1973. In 1973 almost three-fourths of 174 weevils examined were infested. Nematodes ranged from 2 centimeters to 7½ centimeters in length, with one to ten nematodes to a weevil.

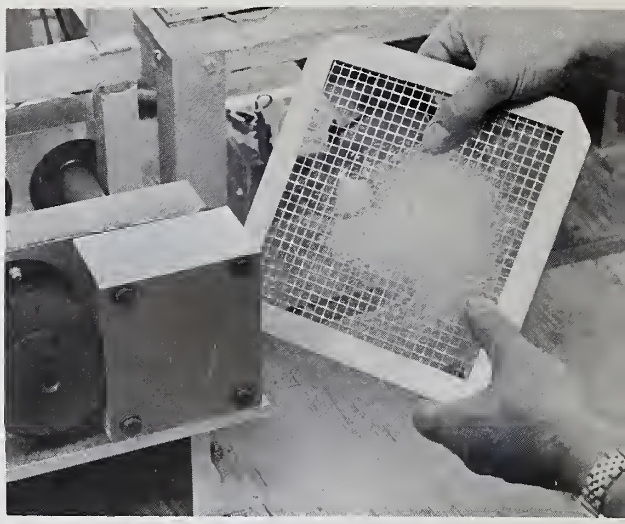
Continued research is in progress at the U.S. Bioenvironmental Insect Control Laboratory at Stoneville, Mississippi.

"When we know its life cycle, it may be possible to mass produce this parasite as a natural method to aid in the control of the weevil," Mr. Cleveland said.

At the present rate of crop destruction and the ecological limitations imposed on insecticides, a natural enemy may be better than a friend. □



Saving steps with spiral carding



Individualized cotton fibers ejected by the experimental spiral card are collected on a coarse wire screen for examination. If used in a mill, these fibers would be picked up by a spinning device and spun directly into yarn, thus eliminating several processing steps, each requiring hand labor (1173X1639–4).

The cover of the spiral card with its spiral grooves is shown with a pencil indicating the discharge opening. One such unit is expected to supply cotton fiber to a single spinning device in an experimental spinning mill radically different from conventional mills (1173X1639–16).

SPIRAL CARDING is a revolutionary new fiber processing system that may eliminate as many as four separate steps in producing yarn from textile fibers.

The new experimental carding system is another step in an overall research program at the ARS Southern Regional Research Center, New Orleans, La., to develop a fundamentally new cotton processing system to replace the system that has been in use, one essentially unchanged for the past 200 years.

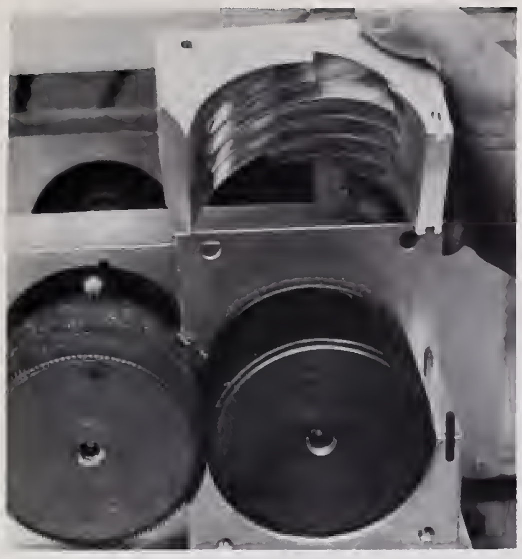
Carding is an essential phase of textile processing. Its primary purpose is to individualize fibers as much as possible so that they can be drawn out into a strand and twisted into yarn. The present system does this reasonably well, but at least three and generally four other steps are required to finally produce a usable yarn. The new device, with its feed system, could eliminate all of them and do it without fiber breakage, a major consideration in any textile fiber processing equipment.

In seeking a new system for individualizing cotton fibers, textile technologist Roger S. Brown and textile engineer Philip L. Rhodes evaluated several approaches including aerodynamics, electrostatics, and a variety of mechanical forces. The researchers finally determined, however, that toothed rolls, similar to those used in present-day cards, still offered the most efficient means of doing the job.

A study was conducted to determine the effects of roll diameter, surface speed, centrifugal force, tooth density, and tooth angle on product quality. Results indicated that small diameter rolls with a high tooth density and rotating at high speed promised most for individualizing or carding the fibers.

The new technique utilizes a high speed (5,000 rpm) 3¼-inch-diameter, 2-inch-long, toothed cylinder covered with a top plate whose inner surface has a spiral groove. This groove conveys the fibers along the length of the cylinder in four revolutions. A bottom plate is smooth and fits close to the tooth-covered carding cylinder.

The top and bottom parts of the cover do not come completely together on one side, but leave a small open slot. A second toothed cylinder, outside the cover and located above a flat base plate, rotates at only 2 to 3 rpm, depending on



Cover plate is removed here to reveal the inner workings of the spiral card. The high operating speed of the toothed cylinder contacts the fibers and throws them into the spiral grooves 3 or 4 times. This action effectively separates the fibers one from another (1173X1639–11).

the desired production rates. This cylinder serves two purposes: 1) it feeds cotton to the device, and 2) it assists in the carding as the cotton being moved along the length of the carding cylinder brushes against its teeth.

In practice, tufts of cotton are fed to a small opening at one end of the covered cylinder whose teeth pick away at the tufts and whip the fibers into the first spiral groove. With each revolution, the flat portion of the cover forces the fibers back against the carding cylinder to allow the fibers to be brushed between the toothed cylinders. The spiral grooves serve to move the fibers along the length of the cylinder. At the end of four revolutions, the fibers are separated one from another and can be moved on a gentle current of air to a device that will spin them into yarn for weaving or knitting.

Research on the new textile processing system is progressing. It is expected that the spiral card will be the device used to feed individualized fibers to each spinning head within the new processing system. Future research will be directed toward incorporating a means of removing trash and neps (knotted fibers) into the new spiral carding technique. □

Sterile yet flavorful

DAIRY RESEARCHERS have long pursued the goal of making a whole milk concentrate of beverage quality that will keep its fresh flavor when stored on the shelf for several months or longer. An ARS scientist may have brought this goal one step closer to achievement by recently discovering additives which overcome the cooked flavor of such sterile milks.

Methods for high-temperature, short-time (HTST) and ultrahigh temperature (UHT) sterilization of milk were developed years ago. They have not, however, fulfilled their promise for making beverage milk concentrates. Milks so sterilized tend to gel in storage and the heat used in processing gives the products a cooked flavor.

The gelling was overcome by the simple addition of polyphosphates (AGR. RES., Dec., 1961, p. 13). Dealing with the cooked flavor has been more difficult because the chemical reactions involved have not been fully understood.

Research by chemist Aldo Ferretti, of the Dairy Products Laboratory in Washington, D.C., confirms that volatile thiols, or sulfhydryl compounds, are primarily responsible for the cooked flavor. The compounds are formed as some of the milk proteins are broken down by the heat of sterilization. Vitamins in milk—notably C, K, and B_6—may play a role in forming these flavor-changing sulfhydryl compounds.

Dr. Ferretti's approach was to find a scavenger for the sulfhydryls—a compound that would not itself affect the wholesomeness or flavor of milk, but rather chemically react with the volatile sulfhydryls, thus "tying them up" and nullifying their bad effects on flavor. He discovered six such compounds. Four of them are thiolsulfonates and two are thiosulfates. The thiosulfonates proved to be the more efficient scavengers for the sulfhydryls.

Only minute quantities of the additives were needed, from 0.003 to 0.05 percent by weight. They proved effective whether added just before or just after the milk was sterilized. In practice, the compounds, purified by filtration, would probably be dissolved in water and injected into the milk after sterilization. This would protect the additive from the heat of sterilization, hence less would be needed.

Pilot-plant tests have confirmed Dr. Ferretti's laboratory studies. There is almost no cooked flavor in freshly made, sterilized milks stabilized with these additives, taste-panel evaluations show. After a few weeks of storage, some stale flavor is detected, but it is much less pronounced than that of control milks without the additive. The additives, besides overcoming the cooked flavor of sterilized milks, may also aid in retarding the stale flavor that develops during storage.

With research results pointing to the efficacy of these additives, their safety would, of course, have to be proved before commerical use. The thiosulfates would probably be approved readily, since they occur naturally in the tissues of many mammals. The physiological effects of thiolsulfonates would have to be established. □

Harrar Named Atwater Lecturer

Dr. J. George Harrar (1273W1739–1).

J. George Harrar, biologist and President Emeritus of the Rockefeller Foundation, will present the sixth W. O. Atwater Memorial Lecture on February 28 in San Francisco, Calif.

The title of Dr. Harrar's lecture is "Nutrition and Numbers in the Third World;" it will be presented before the 140th annual meeting of the American Association for the Advancement of Science. Sponsored by ARS, the Atwater Lecture honors Dr. Wilbur O. Atwater (1844–1907), USDA's first administrator of human nutrition research and a pioneer in the science of modern nutrition in the United States.

Over the last three decades, Dr. Harrar has been a principal strategist for worldwide agricultural production and for the establishment of a network of international agricultural research institutes. He is also noted for the motivation of programs for international cooperation in nutrition research.

Dr. Harrar joined the Rockefeller Foundation in 1943 as the local director of the Foundation's Mexican Agricultural Program. It was during part of Dr. Harrar's tenure in this position that the Foundation sent Dr. Norman Borlaug to Mexico, where he subsequently developed the miracle Mexican wheats; these wheats have helped revolutionize grain production around the world.

Dr. Harrar has received awards and honorary degrees from governments and universities of 14 countries in Central and South America and in Asia. In the United States he has received 13 honorary doctoral degrees in science and law and numerous awards for distinguished service to the science and advancement of agriculture.

Born in Painesville, Ohio, Dr. Harrar earned his doctorate in plant pathology from the University of Minnesota, Minneapolis. Before joining the Rockefeller Foundation he taught at the University of Puerto Rico, Rio Piedras; the University of Minnesota; Virginia Polytechnic Institute, Blacksburg; and Washington State College, Pullman. He was appointed Trustee and President of the Rockefeller Foundation in 1961. After his retirement in 1972, he was named President Emeritus and consultant for the Foundation. He has published several books and over 50 technical articles and monographs.

Speakers for the Atwater Memorial Lectures are chosen for their outstanding scientific contributions toward improving the abilities of people or nations to realize their full potential. □

Tool for water conservation

A new device promises to provide significant aid to workers in water conservation efforts. The device, a vacuum extractor, provides workers with a quantitative measurement of soil water movement as well as a soil water sample for chemical analysis.

Evaluations of irrigation efficiency, plant nutrient utilization, waste disposal, and associated problems necessary for water conservation require accurate determinations of water movement through the soil and of the chemicals collected by that moving water.

The vacuum extractor developed by ARS soil scientist Howard R. Haise, Ft. Collins, Colo., provides the necessary accurate determinations that, until now, were unavailable.

The vacuum extractor is an open-topped, metal trough with a porous ceramic tube in the bottom. The trough is filled with soil and then buried to the desired measurement depth. Controlling the vacuum applied to the ceramic tube removes any water moving through the soil and transports it to a collection bottle for later analysis.

Dr. Haise's tests indicate that the vacuum extractor measuring device measures flow rate within 15 percent of the actual rate.

Current field studies are underway to determine optimum trough size and vacuum control to achieve greater accuracy in capturing a representative sample of both irrigation water moving through the soil and rainfall. □

New Yearbook of Agriculture

Handbook for the Home, the latest Yearbook of Agriculture, is a consumer guidebook assembled in 400 compact, liberally illustrated pages. It suggests ways that families can live fuller, more secure, and more satisfying lives and centers on the home, whether "home" is a suburban house, a country place, or city apartment.

Most of the 1973 Yearbook authors are either with USDA or the State universities and land-grant colleges, and 15 are ARS scientists. *Handbook for the Home* contains 78 chapters, more than 190 photographs, and is divided into four major sections.

"Families," the first section of the book, covers such subjects as home safety, food handling, living costs, money management plans, drug abuse, nutrition, indoor gardening, and camping and recreation. The second section, "Dwellings," is devoted to a broad range of subjects, such as site selection, financing a home, insurance, legal hurdles, house plans, electricity, water management, climate control, and making housework easier.

The third section, "Furnishings," discusses the esthetics of color, texture, and design; floor coverings, lighting, portable storage units, appliances, sound systems, and clothing. The final section, "Communities," is devoted to how communities can work together to stretch resources; this section furnishes guidelines for community services and health, environmental planning, and cultural opportunities.

The Yearbook may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Members of Congress have a limited number of copies for free distribution.

Soil degrades cooking oils

COOKING OILS used in potato processing pose no hazards in land treatment and waste water disposal. Palm and soybean oils—even when applied to soils in mammoth concentrations—decompose rapidly, presenting neither special problems nor toxicities.

Applying waste materials to agricultural land is a centuries-old practice. Indeed, disposing of certain wastes on the land can help clean up the environment. Two systems, developed recently for the potato processing industry, utilize spraying or surface irrigation with potato processing wastes, instead of dumping this effluent into streams and rivers.

Cooking oils used in processing potatoes sometimes get into the waste water effluent. These oils contain a high carbon content, and lack the nitrogen, sulfur, and phosphorous usually found in waste materials ordinarily applied to the soil. Accordingly, the soil must supply the deficient minerals to decompose the oil, thereby immobilizing soil nutrients while the oil decomposes.

To determine how serious the effects of cooking oils in soil are, ARS soil scientist J. Hamilton Smith, Kimberly, Idaho, melted palm and soybean oils in a water bath and mixed in Portneuf silt loam soil at rates of 0.1, 0.5, 1.0, and 5.0 grams per 100 grams of soil. He then added nitrogen and incubated the mixtures at constant temperature in a carbon dioxide-free continuously flowing air stream.

Calculated decomposition percentages give rates of 70, 76, 44, and 44 percent for the lowest to the highest oil applications. No difference showed for the two oils in their decomposition rates for 12 weeks. Nitrogen deficiency in the test soil may have contributed to the lower decomposition rates of the 5.0- and 1.0-gram oil applications.

As a result of this rapid decomposition, there is little possibility that oil will accumulate and create problems when food processing waste water containing low cooking oil concentrations is applied as an effluent in land treatment operations.

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AGRISEARCH NOTES

Wheatgrass resists range fires

SEEDING burned rangelands to crested wheatgrass—a relatively fire-resistant vegetation—reduces the hazard of fire to Western homes. This wheatgrass is well adapted to Nevada's growing conditions and will suppress cheatgrass, the major cause of rangeland's high flammability.

Range scientists Raymond A. Evans, Richard E. Eckert, Jr., and James A. Young report that the seeding of perennial grasses after a fire also prevents the establishment of seedlings of root-sprouting shrubs that are allergenic (rabbitbrush), spiny (desert peach), or toxic (horsebrush). Once these plants become established, the usefulness of property is reduced.

The three scientists, working in cooperation with the Nevada Agricultural Experiment Station, Reno, recommend that areas burned in wildfires be seeded to perennial grasses the first fall after the burn. If the burn is not seeded the first year, chemical or mechanical weed control must be practiced to reduce stands of cheatgrass before seeding.

Many years of range research indicate that planting seeds with a deep furrow-rangeland drill is the best way to establish grasses. Already more than a million acres have been seeded to crested wheatgrass. The seed is relatively inexpensive and widely available at farm supply centers. Native wild flowers, such as lupine and balsam root, reestablished themselves with the wheatgrass to make the firebreaks a colorful landscape.

When reporting research involving pesticides, this magazine does not imply that pesticide uses discussed have been registered. Registration is necessary before recommendation. Pesticides can be injurious to humans, domestic animals, desirable plants, and fish or other wildlife—if not handled or applied properly. Use all pesticides selectively and carefully.

PROTECT
Use Pesticides Safely
FOLLOW THE LABEL

Slow-rusting wheat

A SPRING WHEAT susceptible to stem rust may still produce kernels of nearly normal size when infected if it is a "slow ruster."

ARS plant pathologist James D. Miller identified two slow-rusting breeding lines, in which infection developed very slowly during plant growth, among spring wheats rated moderately susceptible or susceptible to the disease. At the late dough stage of ripening, average severity of infection was only 4 and 14 percent in these lines. Average kernel weight was 87 percent and average bushel weight was 95 percent of rust-free controls.

By contrast, kernel and bushel weights of the fast-rusting Marquis variety were respectively 59 and 85 percent of the controls.

In experiments in cooperation with the North Dakota Agricultural Experiment Station, Fargo, Dr. Miller also identified two spring wheats with an intermediate slow-rusting pattern, in which severity of infection developed slowly after an increase occurred early in plant development. Their kernel and bushel weights were 86 and 96 percent of the rust-free controls.

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